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tions under which bright line radiation takes place in these stars on the one hand, and in some of the white stars and the nebulae, on the other, but also because they may prove suggestive in the study of the nature of the red variables. The observers of the Harvard College Observatory have noted numerous irregularities in the intensities of the members of the hydrogen series of bright lines, which undoubtedly will repay close study.

I wish to acknowledge my indebtedness to Dr. Merrill for the use of a print of the spectrum of R *Aquarii* and to Dr. Moore for the privilege of examining the plate secured by him.

November, 1919.

W. H. WRIGHT.

SPECTROSCOPIC OBSERVATIONS OF TWO RECENTLY
DISCOVERED NOVAE

The two new stars recently announced by Professor Bailey of the Harvard College Observatory as having been discovered there by Miss Mackie have been examined spectroscopically at the Lick Observatory.

Nova Sagittae, R. A. = $20^{\text{h}}3^{\text{m}}.1$; Dec. = $+17^{\circ}.6$ (1900) *H.C.O. Circular* No. 219. This star is reported to have appeared as a nova of 7.2 magnitude in 1913. It is now relatively faint and is described as closely following a 14.5 magnitude star. Preliminary to a spectroscopic observation of its spectrum a finding plate was kindly photographed by Dr. Curtis with the Crossley reflecting telescope. On this plate the nova is much brighter than the companion referred to above.

Two spectrograms have been secured with the small slitless spectrograph attached to the Crossley reflector. The dispersion is very low and the record faint but the general character of the spectrum is apparent. It is continuous and lies chiefly in the ultra-violet. The intensity is pretty uniform thruout its length. While no bright nor dark bands are visible in the spectrum the possibility of their existence is not precluded; the dispersion used is very weak and the observation can be taken as establishing only the general nature of the radiation.

The stellar image on Dr. Curtis's plates is stronger than one would be led to expect from the Harvard description of it; it is particularly intense on a Seed No. 23 plate, as compared with a No. 30. This is doubtless to be accounted for by the spectral peculiarity of the star. Its light lies very largely in a region to

which glass is only partially transparent, but which is within the range of a reflector. Since the Harvard photographs were made with a refractor and those at Mount Hamilton with a reflecting telescope the difference in intensity is readily explained. The observations furnish an instance in which the so-called color-index of a star depends upon the nature of the apparatus with which the photograph is made.

Nova Ophiuchi R. A. = $18^{\text{h}}9^{\text{m}}.5$; Dec. = $+11^{\circ}.6$ (1900). The history of this star is sketched in the Harvard College *Bulletin* No. 696. Notification of its discovery reached the Observatory on October 30th, and its spectrum has since then been observed as systematically as the somewhat unfavorable weather has permitted. The star is reported to have been at magnitude 7.5 on September 13th and, with striking fluctuations in brightness, to have declined to magnitude 9.5 in October. The first observation was secured with the large Crossley slitless spectrograph on October 30th, and showed the bright bands of hydrogen and enhanced iron characteristic of the post-maximum nova spectrum. The spectrum resembled that of *Nova Geminorum* No. 2 as it appeared on March 18, 1912, a few days after maximum. The bands in the present nova were, however, very much narrower at that time. The star increased in brightness reaching a magnitude of about $7\frac{1}{4}$ on November 5th; it therefore achieved a second maximum comparable with its first. Since then it has fallen off in brightness and on November 13th was estimated to be of about $8\frac{3}{4}$ magnitude. These estimates of brightness are very rough and are based on the Durchmusterung magnitudes of a few stars in the finder field.

The observations after that of October 30th, referred to above, were made with a slit spectrograph and are therefore not strictly comparable with it, but the rise in brilliancy of the star appears to have been marked by an increase in the strength of the continuous spectrum relatively to the bright bands, and its decline was certainly due to a corresponding subsidence of the continuous spectrum. At the time of maximum many of the bright bands were all but obliterated by the strong continuous radiation. With the fading of the star the emission bands in its spectrum broadened out and are now of a width comparable with those in the spectra of previous novae. The emission bands, particularly those of hydrogen, have at all times been accompanied by the usual dark absorption lines, displaced toward the violet. The present appear-

ance of the spectrum is very much like that of *Nova Geminorum* on March 18, 1912, the date previously referred to.

The continuous spectrum which characterized the rise to maximum contained numerous strong dark lines, and furnishes a most remarkable example of what may perhaps be called the typical dark line nova spectrum. The resemblance to the spectrum of *a Cygni*, remarked in previous novae by other observers, is more striking than was the case with *Nova Aquilae*, or in fact with any nova that has come under my observation. The stellar lines are, as usual, displaced in the nova to correspond with the dark hydrogen lines. The line absorption overlies the hydrogen emission bands.

The dark line spectrum has, in previous novae, characterized an early period, an interval close to the outbreak of the star, and has been followed by the so-called "bright-band" stage. The reversion to the earlier type, in the present instance, coincident with the rise to second maximum suggests that the forces which act to produce a nova were called into play a second time.

The spectrum of this star offers the possibility of determining with a great degree of certainty the constituents of the atmospheres of new stars. It ranks in interest with those of the brighter novae of recent years.

W. H. WRIGHT.

COMET NOTES

The Brorsen-Metcalf comet, known earlier as Metcalf's first comet of 1919, passed perihelion on October 16th. It is now in the morning sky, having passed the Sun, and it is moving southward. By the first of November it was difficult for northern observers, because of the nearness to the Sun, and the southern declination. Two observations were secured, however, at the Lick Observatory on November 3rd and 4th.

These two positions indicate that the elements given in *Lick Observatory Bulletin* No. 324 are quite close to the truth, for the observations are represented within the numerical accuracy of the ephemeris. It appears that the period of 72.1 years will not be much changed by any increase in observational data. In this connection an announcement emanating from the Copenhagen computers is of interest. They have obtained an orbit with a period of only 42 years, so that it seemed likely that there had been two